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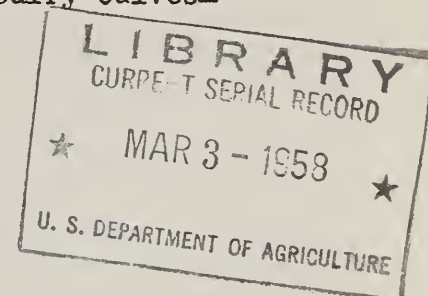
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R 31
Cap. 3

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

ARS 52-52

A Comparison of Alfalfa Hay and Wilted Alfalfa Silage Supplemented
With Additional Grain or Hay as Roughage for Growing Dairy Calves^{1/}

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The extent to which growing dairy calves can be reared on roughages has been under investigation by the Dairy Husbandry Research Branch at Beltsville for several years. Satisfactory growth and development has been obtained on the following feeding schedule.

Whole milk: A limited amount until 60 days of age with none thereafter (370 lb. total).

Grain: Up to 3 lb. per day until 5 months of age then 2 lb. per day for 3 months, no grain after 8 months of age (under 500 lb. total).

Roughage: Unlimited amounts of U. S. #1 alfalfa hay.

We have previously reported that wilted alfalfa silage fed in place of alfalfa hay in the above feeding regime resulted in reduced rates of gain for dairy heifers (1, 2). The addition of small amounts of alfalfa hay (1/2 lb./cwt.) to the silage fed calves improved growth but it was still below that of calves receiving only alfalfa hay.

In the trials reported here the use of corn silage, larger quantities of grain and of alfalfa hay with the alfalfa silage were investigated. A comparison of the growth resulting when a 16% protein (D. M. basis) grain 29% protein mixture replaced a grain mix in this feeding schedule was also obtained.

Information on the grouping, feeding, consumption, body weights and rates of gain for the groups of calves in these trials are presented in table 1. The cumulative growth curves are shown in figure 1. Calves in groups 6 and 10 and those in groups 8 and 11 were combined for the graphic presentation. The data for calves in group 1 have been presented previously (1, 2) but are used here only for the comparison between high and low protein grain mixtures.

RESULTS

There were only small differences in the growth of calves in groups 5, 6, 7, 8, 9, 10 and 11 during the first 8 months of life. When grain was omitted at 8 months of age in groups 5, 6 and 10 there was an absolute and comparative reduction in rate of gain for these calves. This was more noticeable with the Jersey calves than with the Holstein calves. Similarly there was an absolute and comparative reduction in rate of gain for calves in groups 8 and 11 after grain was removed at 12 months of age.

^{1/} Paper presented at the annual meeting of the American Dairy Science Association, June 26-29, 1957 at Oklahoma A. U. M. College, Stillwater, Oklahoma.

At 21 months of age the calves receiving silage and hay (groups 6 and 10) and those receiving grain (group 7) were only slightly lighter in body weight than the calves receiving alfalfa hay (groups 1 or 9). All these groups approached or surpassed the Ragsdale standard (R in figure 1) but were somewhat below the standard of Matthews and Fohrman (D in figure 1) at the older ages. Calves receiving equal parts of alfalfa and corn silage (group 5) had low body weight gain after 8 months of age and were small and retarded at 21 months of age. Their performance was very similar to that reported for calves receiving only wilted alfalfa silage (1, 2). The feeding of grain to 12 months of age (groups 8 and 11) improved body weight gains especially during the grain feeding period but at 21 months of age these calves were only slightly larger than calves fed silage and grain to 8 months of age.

The consumption of dry matter paralleled the body weight gains made by the calves on the various roughages. The consumption of dry matter by calves in groups 5, 8 and 11 and the body weight gains were much below those of the other groups and especially during the second year of life. The dry matter consumption of calves in groups 1 or 9 was usually higher than for calves in any other group. When intake was expressed as dry matter per 100 lb. body weight the calves in groups 5, 8 and 11 had the lowest value of all groups at comparable ages or at comparable body weights. The reasons that silage fed calves voluntarily consume smaller quantities of dry matter than calves receiving hay is not known.

One small trial was performed in an attempt to obtain information on this subject. The effluent liquid from a silo was absorbed on alfalfa hay for a trial period using two heifers when they were 25 months of age. The daily dry matter consumption by 10-day periods for each of these heifers is indicated graphically in figure 2. Alfalfa hay was fed in unlimited amounts at all times and the liquid was absorbed on the hay daily for a 37 day period. During the latter portion of this trial period the dry matter consumption was noticeably reduced. Consumption did not attain its pre-trial level until at least 10 days after silage liquid supplementation ceased.

In one trial the comparative consumption of alfalfa hay and alfalfa silage was obtained when both were fed free choice and when the hay was limited to 1/2 lb./cwt. from 0 to 6 months of age. A summary of this data obtained on 2 groups of calves of both Holstein and Jersey breeds is shown in table 2. In this free choice trial the Jersey calves consumed more dry matter as hay than as silage whereas the Holstein calves consumed more silage than hay dry matter. In the limited hay schedule calves of each breed consumed 3.35 times as much dry matter as silage than as hay. Calves gained more when hay was fed in unlimited amounts in this comparison.

A comparison between protein levels in the grain mixture can be made by comparing the gains of groups 1, 6 and 8 with those of groups 9, 10 and 11. A summary of this comparison is shown in table 3 for the period from 2 to 8 months of age, when the grain was fed, and for the period from 8 to 12 months of age after grain was removed from groups 1, 6, 9 and 10.

At the younger age each respective group of calves receiving the grain with the higher protein content had higher body weight gains. The differences were statistically significant in only about half of the groups.

At this younger age the calves fed hay did not always gain more than those receiving silage. The amount of grain consumed by calves in group 9 both Holstein and Jersey was less than that consumed by the other groups. It is possible that variations in voluntary grain consumption may have obscured differences due to the roughages and/or the grain mixtures used in this trial at the younger age. At the older age (8 to 12 months) each group of calves receiving hay (groups 1 and 9) had larger gains than the calves receiving silage and hay (groups 6 and 10) or silage and grain (groups 8 and 11). These differences were usually statistically significant (table 3). Groups 8 and 11 were fed the same amount of grain during this period but the differences between grain were not sufficient for statistical significance.

The data in table 3 and other observations suggest that gains during the early life may be somewhat dependent upon the amount of grain consumed. Although the same amount of grain is offered to the young calves the amount consumed during the first four months was found to be highly variable. The amount of grain consumed from birth to 4 months of age by Holstein calves was found to vary from 168 to 259 lb. and for Jersey calves it varied from 65 to 207 lb. The respective range in body weight gains was 68 to 176 lb. and 43 to 125 lb.

Data from calves in groups 1, 5, 6, 7, 8, 9, 10, 11 and a current group were obtained and a significant positive correlation was found between amount grain consumption and gain during the first 4 months of life. A summary of these calculations are shown in table 4.

SUMMARY

Young dairy calves can be successively reared to calving time on a ration using only 370 lb. of whole milk, 500 lb. of grain and unlimited quantities of good alfalfa hay. When alfalfa silage or equal parts of alfalfa and corn silages replace the hay in such a feeding schedule low rates of gain and unsatisfactory growth resulted. The use of wilted alfalfa silage plus 1 lb. alfalfa hay per cwt. or wilted alfalfa silage plus 2 lb. grain per day to calving produced calves that were only slightly smaller (yet significantly smaller) than calves fed on hay only. Calves fed the wilted alfalfa silage consumed less dry matter than calves fed hay. Reasons for the decreased consumption of silage is not apparent. In these experiments the amount of grain consumed during the first 4 months of life was significantly correlated with gain in body weight.

REFERENCES

1. J. F. Sykes, H. T. Converse and L. A. Moore, J. Dairy Sci., 38: 1246. 1955.
2. J. F. Sykes, L. A. Moore and H. T. Converse. Mimeo ARS 52-8. 1955.

Table 1 - Rations fed and body weights of female calves on the roughage experiment

	GROUP							
	1	5	7	6	8	9	10	11
Roughage fed	Alf Hay	Alf & Corn Silage	Alf. Sil.	Alf. Sil. & Alf. Hay (1 lb/cwt)	Alf. Sil.	Alf. Hay	Alf. Sil. & Alf. Hay (1 lb/cwt)	Alf. Sil.
Grain fed								
% protein	29	29	29	29	29	16	16	16
lbs.	500	500	1500	500	750	500	500	750
Grain removed (mo)	8	8	24	8	12	8	8	12
Dry matter consumed (lb. to 21 mo.)								
Holstein	8876	5458	7594	7594	7327	8178	7302	6796
Jersey	5824	4177	5764	5451	4974	5630	5083	4168
Body weight (lb.) Holstein calves								
No of calves	7	7	6	6	6	7	6	7
0 mo.	88	91	90	81	97	96	92	93
8 mo.	467	343	394	409	392	390	403	357
12 mo.	670	444	563	541	588	589	551	515
24 mo.	1034	734	922	915	916	984	942	801
Body weight (lb.) Jersey calves								
No. of calves	10	8	7	6	7	4	5	4
0 mo.	54	59	47	48	53	49	48	46
8 mo.	282	282	267	289	304	274	265	265
12 mo.	417	343	372	378	415	414	347	347
24 mo.	647	526	630	613	566	653	582	550
Daily gain (lb/day/calf) Holstein calves								
0-8 mo.	1.58	1.05	1.27	1.45	1.23	1.23	1.25	1.10
8-12 mo.	1.62	.81	1.35	1.05	1.57	1.59	1.18	1.26
12-21 mo.	1.35	1.07	1.33	1.38	1.21	1.46	1.45	1.06
Dairy gain (lb/day/calf) Jersey calves								
0-8 mo.	.95	.80	.92	1.00	1.04	.95	.91	.92
8-12 mo.	1.04	.49	.94	.71	.89	1.12	.66	.66
12-21 mo.	.85	.68	.95	.87	.56	.89	.87	.75

Table 2 - Consumption of hay and silage by young calves when allowed free choice compared to limiting the consumption of hay.

Breed and No. of calves	Hay feeding schedule	Dry Matter consumed 0-6 mo. of age			Gain
		Hay (1b/day/calf)	Silage (1b/day/calf)	Grain (1b/day/calf)	
Holstein (3)	unlimited	.74	2.43	1.69	1.37
Holstein (3)	1/2 lb/cwt	.62	2.09	1.87	1.26
Jersey (5)	unlimited	.95	.76	1.44	.98
Jersey (5)	1/2 lb/cwt	.33	1.12	1.27	.83*

Table 3 - Comparison of growth of calves fed the two grain mixtures with the various roughages.

Group No.	High Protein Grain Mix Gain	Significance of Grain Difference	Low Protein Grain Mix Gain	Combined Average
	(1b.)		(1b.)	
		1b. gain from 2 - 8 mo. (1b.) (Holstein)		
1 - 9	323	---*	254	289
6 - 10	283*		258	272
8 - 11	255**		218**	235**
Av.	<u>289</u>	---**	<u>243</u>	
		(Jersey)		
1 - 9	196		194	195
6 - 10	207	---*	178	194
8 - 11	<u>212</u>	---*	<u>183</u>	202
Av.	204		185	
		1b. gain from 8 to 12 mo. (Holstein)		
1 - 9	202		199	200
6 - 10	132**	none	147*	139**
8 - 11	196**		159*	175*
		(Jersey)		
1 - 9	136	none	140	137
6 - 10	89**		82**	86**
8 - 11	111		81**	100**

* p = 0.05

** p = 0.01

Table 4 - Relation between lb. grain consumed (X) from 0 to 4 months and the lb. of body weight gain (\bar{Y}) in calves.

Breed	No. calves	Correlation Coefficient	Regression equation	st. error of b	t
Holstein	71	.50**	$\bar{Y} = 46.6 + 0.41X$.08	4.9**
Jersey	74	.70**	$\bar{Y} = 37.5 + 0.36X$.04	9.0**

** p = 0.01

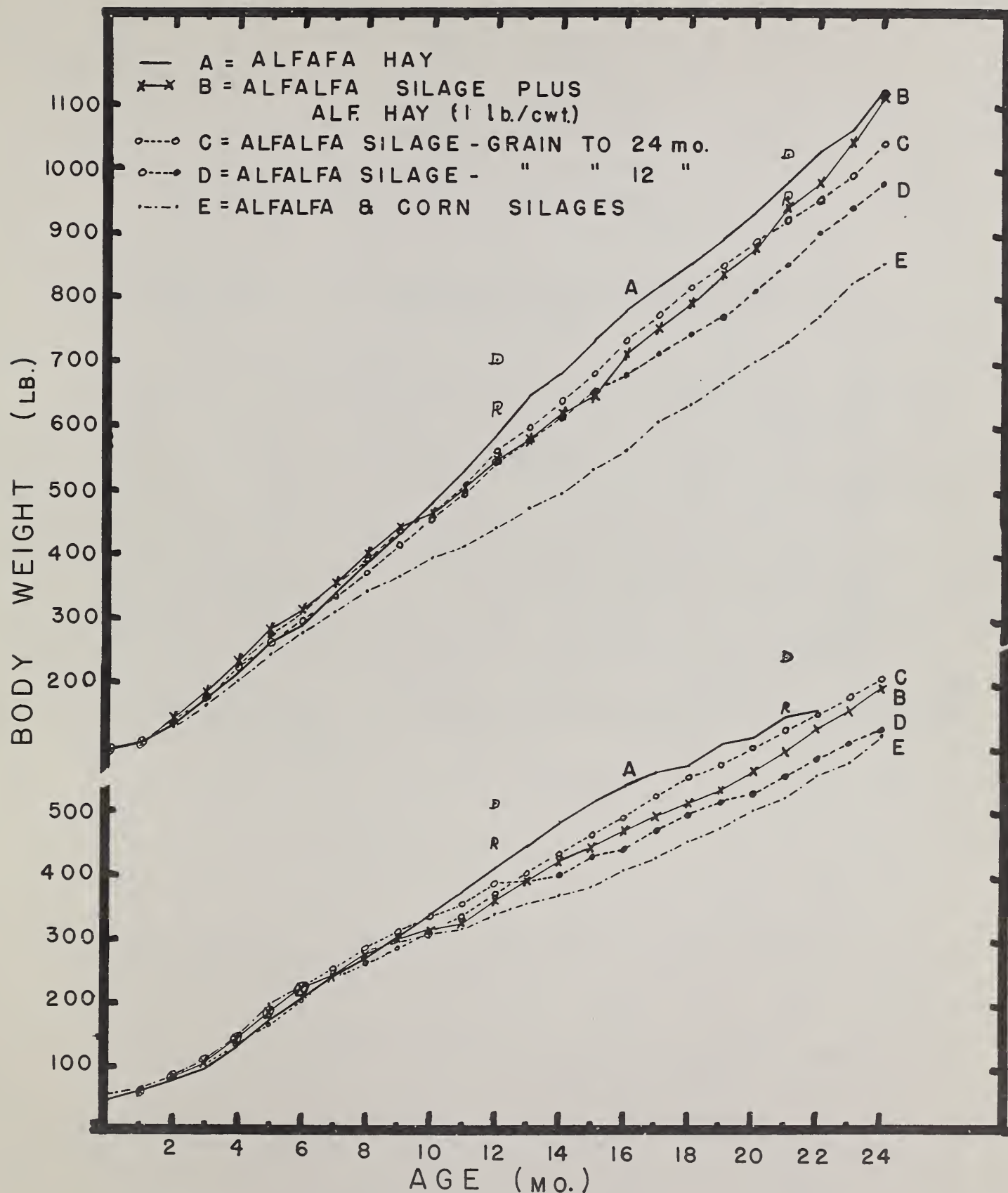


Figure 1 - Body weights of Holstein Calves (upper lines) and Jersey Calves (lower lines) fed the various roughages at the ages indicated. R = Ragsdale standard; D = Matthews and Fohrman standard.

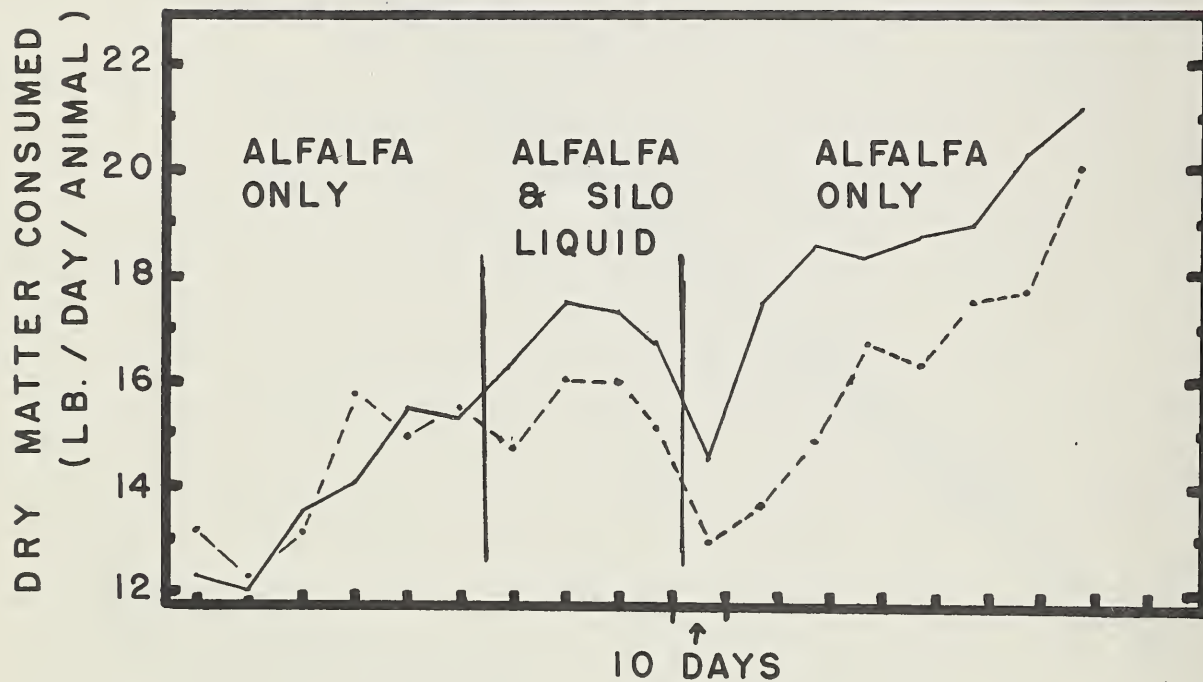


Figure 2 - Dry Matter Consumption by 10 day periods of two heifers receiving alfalfa hay and including a 37 day period when the hay was soaked with silage liquid.